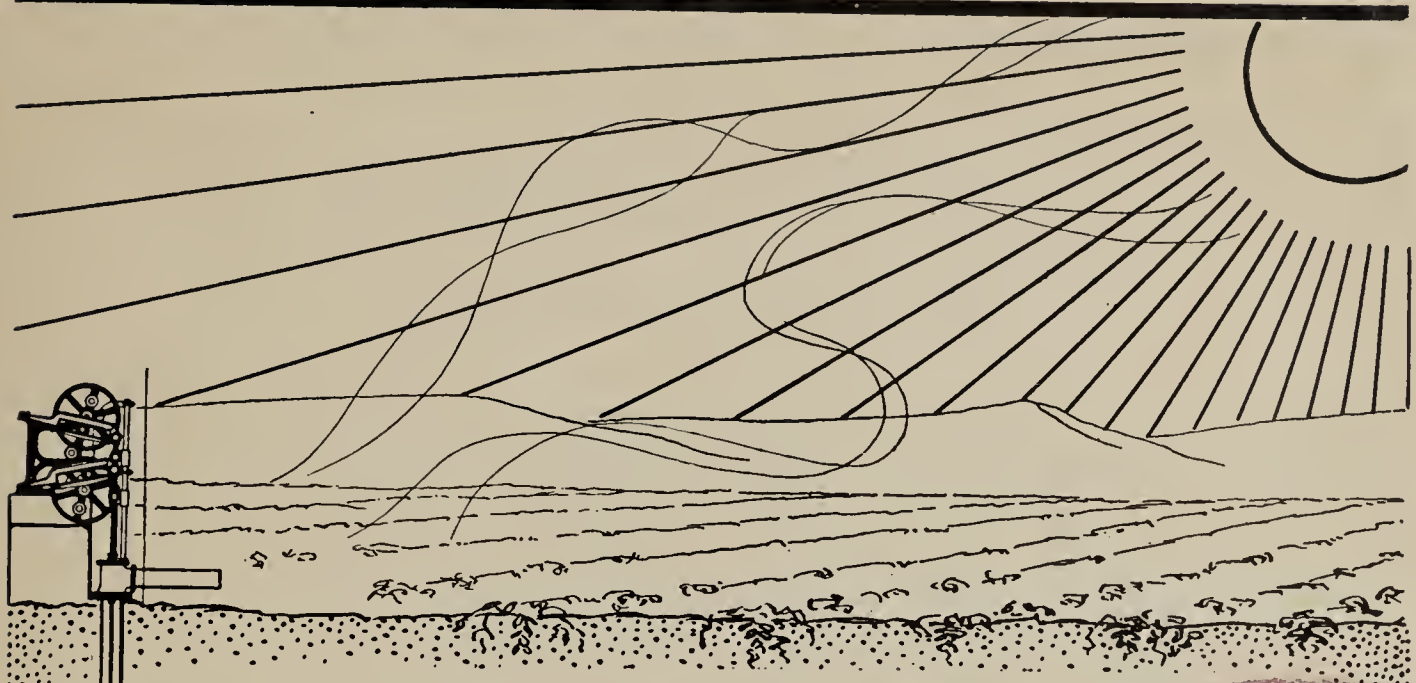

IF THE WELL RUNS DRY

A NEW SOUTHERN HIGH PLAINS FARM ENTERPRISE AND ITS EFFECT ON THE GROUND-WATER SUPPLY

U. S. DEPARTMENT
OF AGRICULTURE

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IF THE WELL RUNS DRY

Potatoes in the High Plains

Based entirely on the use of ground water through well irrigation, the potato industry in the Southern High Plains—and particularly in the Hereford and Plainview areas—has been increasing at an enormous rate in the past few years. Other irrigated crops, such as grain and forage products, are rapidly being pushed into the background.

The Hereford area alone has an estimated potato acreage this year of 2,000 or more acres, about seven times that of last year, and predictions of 10,000 acres in 1941 already are being made. Near Lockney there are about 500 acres, and in the House area of Quay County, N. Mex., about 170 acres. There are 100 acres around Lubbock, and some acreage in the vicinities of Muleshoe, Levelland, Anton, Shallowater, and Roundup, in addition to a few growers in Swisher and Hale Counties.

Well irrigation has been used for some time to raise wheat and sorghums. The amount of water used for these crops, however, is negligible compared with what will be required for the potatoes, if the present rate of increase in potato acreage is maintained.

Potato production on an extended scale began several years ago when an Idaho grower who had moved into the Hereford area started planting potatoes on land formerly used for wheat and sorghums. It proved profitable, and soon other growers, both from Idaho and from the Panhandle area, followed suit. This year the total number of growers in the Hereford area is estimated at 75, with about half of the acreage held by Idaho growers. In addition to the potatoes, a few onions are being raised, and some farmers are experimenting with carrots.

No Water, No Potatoes

The soil is favorable to the production of potatoes throughout large sections of the High Plains; there is no lack of men to cultivate them, and capital to continue the rapid advance of this new enterprise appears to be available, either locally or from the outside. But beyond all these factors, the continued growth of the potato industry is dependent entirely upon the ground-water supply. Without the necessary water from wells hardly an acre of potatoes could be harvested commercially in the High Plains.

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Little thought has been given to the matter of continued well irrigation, apparently because of the popular assumption that an inexhaustible supply of water underlies the entire area—an assumption not shared by those geologists and hydraulic engineers who have studied the area. Yet if the water supply fails under the heavy burden placed upon it by the raising of potatoes in constantly increasing amounts, the new enterprise will inevitably collapse and the land will be returned to pasture or dry farming. Figure 1 graphically illustrates the hydrologic cycle on the High Plains.

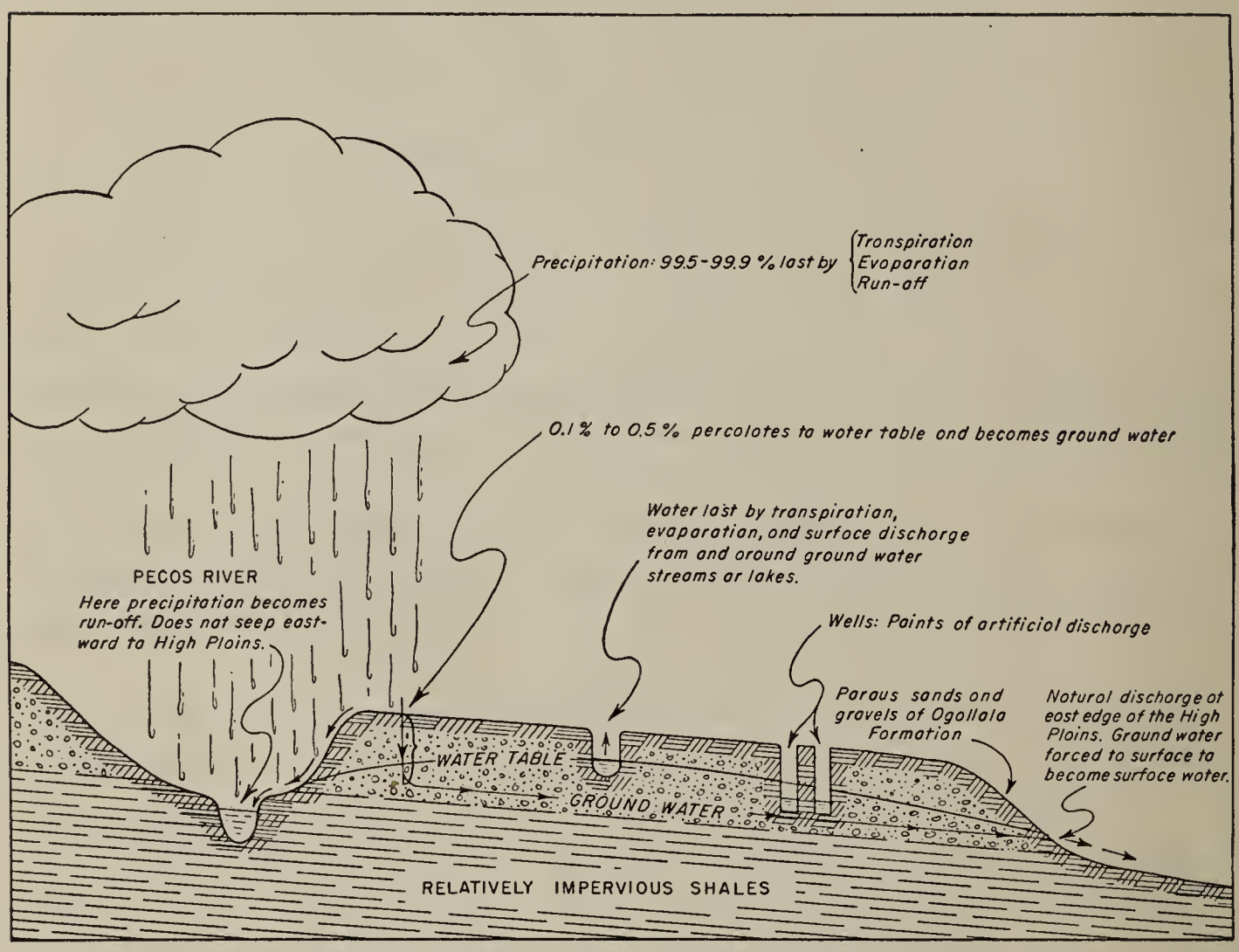

FIGURE 1.—Graphic illustration of the hydrologic cycle on the High Plains.

For this reason, such information as has been collected by experts on the ground-water situation in the High Plains will be briefly summarized here. Because the Hereford area has taken the lead in the use of wells for potato production, it will be frequently cited. It must be kept in mind, however, that *as far as the ground water supply is concerned, the entire Southern High Plains are similar to the Hereford area.*

A Community Well

The ground-water supply underlying the Hereford-Plainview area, and the High Plains in general, can and should be thought of as a huge community well, in which each resident has a share and an

interest. There is a bottom to this well. The greater the draft on the ground-water supply, the faster the water level will recede. The drawing in figure 2 will help to make this process clear. Unless pumping is halted, or at least controlled sufficiently to allow the water level to rise through natural recharge, the depth to the water level will soon be beyond the limit of profitable pumping. Although there is a continual seepage into the well from the west, it is almost exactly balanced by a continual drainage out to the east. When water is withdrawn from the well, the inflow does not increase, nor does the output decrease appreciably. It maintains essentially the same balance, and the result is for all practical purposes the same as if there were neither inflow nor output.

In other words, the ground-water supply of the High Plains is entirely at the mercy of those who use it. It is neither inexhaustible nor can it be replenished unless pumping ceases for an extended period of time. Every gallon of water pumped lowers the water supply a given amount.

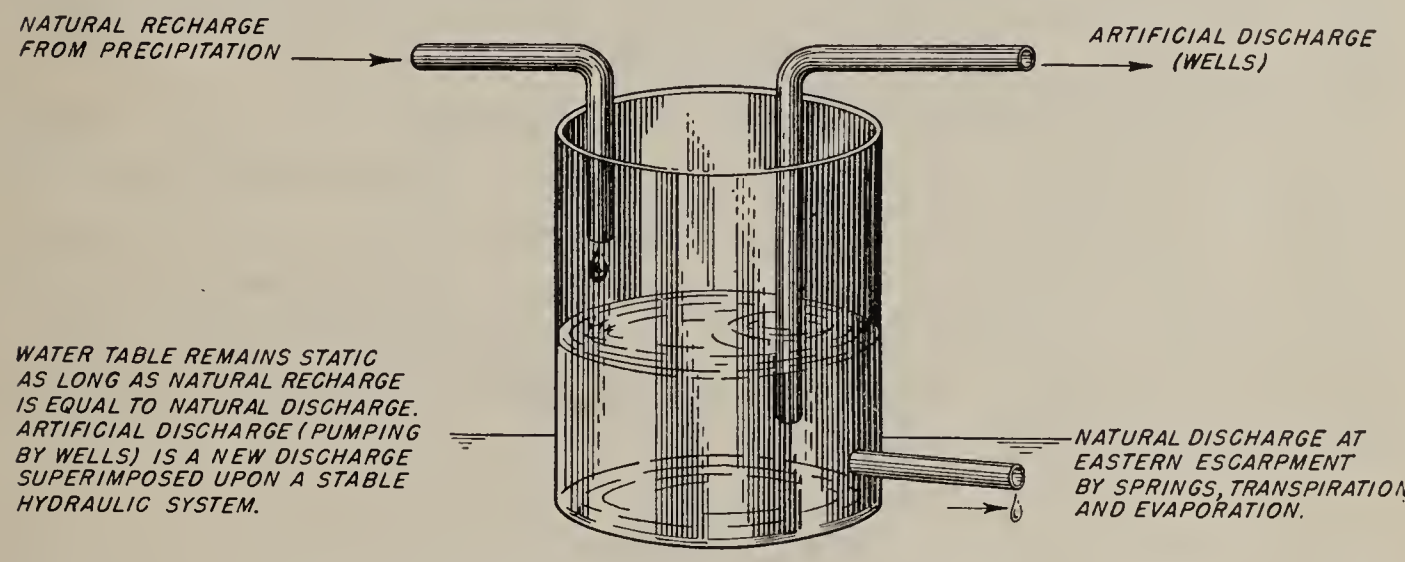

FIGURE 2.—The High Plains hydrologic cycle when the ground-water supply is regarded as a huge community well.

Finally a situation may be reached where the underground water level is so far down that the farmer can no longer afford to pump the water up for irrigating purposes. The maximum depth from which the farmer can afford to pump irrigation water varies, depending upon such factors as managerial ability and distance from markets; but in general, 110 feet is about the limit.

Whether the water should be used, and, if so, how much, is a problem to be met later. The only purpose here is to point out the depletability of the water supply.

This situation—in which the recharge and discharge of the water exactly balance each other—is referred to by geologists as a state of transient storage, and the height of the ground-water level is known as the water table. When a state of transient storage occurs, as in the High Plains area, the height of this water table remains unchanged—

unchanged, that is, so long as water is not withdrawn from it artificially, as by well irrigation.

Planned Water Use

The issue presented by this set of physical conditions is a simple one. The Hereford area, the Plainview area, and all other areas in the High Plains that now, or in the future, utilize water in this manner, must face the issue of how long they wish to continue as irrigation areas. That is, should they draw a planned amount of water over a planned interval and enjoy a long, spread-out planned economy, or should they pump the available supply as quickly as possible and then go back to dry-land farming?

This question applies equally well to the prospects for investment returns on irrigation equipment of individuals. Does the Hereford area, for instance, owe security to investors which should take the form of guaranteeing that pumping be spread over a long period? For, if too many wells are developed, it is entirely possible that the water will recede beyond the point of economical pumping before an investor has even paid for his equipment.

Again taking the Hereford area as an example, the question may be raised concerning what effect the present intensive irrigation has on the water supply. It must be recognized at the outset, however, that because it is impossible to predict how greatly irrigation will expand in the area, it is therefore impossible to predict with certainty how long the water table will remain within profitable pumping distance of the land surface.

Water Loss

It is possible, however, to predict in a general way the effect of the rate of ground water pumping on the area's water table. This can be done by comparing the current rate of the water-table decline there with the amount of water being pumped.

The rate of pumping in the area—the number of pump installations being made—is increasing at a rate that can well cause alarm to those who have irrigation investments in the area; certainly any new investments should be made with an awareness of the rate of *pumping increase*. The current rate of annual water recovery in the area is not especially alarming. The danger lies in three other factors. These are: (1) The rate of pumping increase; (2) the trend toward application of water on crops whose water requirements are high; (3) the complete absence of legal protection to irrigators in the area—the absence of any form of administrative control over water use.

The United States Geological Survey has provided the following figures on the rate of pumping in the area shown in table 1.

TABLE 1.—*United States Geological Survey data on approximate number of pumping plants operating in this area and approximate amount of water pumped, 1934–39*

Year	Pumping plants operating	Water pumped	Year	Pumping plants operating	Water pumped
	Number	*Acre-feet*		*Number*	*Acre-feet*
1934		40	1937	170	26,000
1935		50	1938	240	35,000
1936	70	(1)	1939	275	(1)

[1] No figure.

The significant fact in the above table is the tremendous increase in the number of acre-feet of water pumped annually. The 1939 figure is not yet available, but there is every probability that it will approach 50,000 acre-feet.

The following figures show that the present rate of pumping results in a declining water table. Records of this are complete for only one year, but they are indicative of a trend. From March 1939 to March 1940 the following general lowering of the water table, taken from an average of 56 observed wells, occurred throughout the area:

Location:	*Decline (feet)*
West of Hereford	0.95
East and southeast of Hereford	1.12
North and northeast of Hereford	1.18

Although this shows a decline of more than a foot, it is not sufficient to have any serious effect on the water supply. What is significant is that increased pumping will mean declines in the future of considerably more than a foot a year.

Potatoes, Wheat, and Forage Crops

The new wells are being sunk almost entirely for the production of potatoes; and potatoes require an enormous amount of water. An acre of hegari, milo, Sudan grass, wheat, and most other crops which formerly used the irrigation water, need approximately 1 acre-foot, or less. The Lubbock, Tex., Experiment Station has stated that in the Hereford area potatoes probably will use approximately 3⅓ acre-feet a year. Others put the figure still higher.

Putting the matter briefly: Irrigation in the Hereford area lowers the water table; potato production, which is being rapidly expanded, requires a particularly heavy irrigation. Therefore, unless some form of control is brought to bear, the water table will be lowered more and more rapidly until it lies below the limit of profitable pumping.

Methods of Control

The situation leaves two courses open. One is simply to let things continue as they are. If this is to be done, no further discussion is necessary. The other course is to adopt a method of control chosen by those whose interests are involved. It will be taken for granted here that those interested in potato irrigation want to make the best use of their water.

In contrast to various other States, New Mexico for instance, Texas has absolutely no form of control over the rates of water recovery in the State. Yet there is no logical argument against control over areas of the Hereford type. The consequence of uncontrolled development in such areas will be a greatly reduced water supply making it unlikely that the investment in irrigation equipment can be returned. The larger consequence could be the creation of a mushroom, flash economy that would make no constructive contribution to the stabilization of an agricultural economy in the plains.

An all-important point is the form control should take. Certainly there should be no impairment of the rights of those who have invested their time and money in the new enterprise—an enterprise which can provide a prosperous economy for a substantial number for an indefinite time to come.

Above all, farmers in such areas as Hereford should realize that control of the rate of ground-water recovery in their area is not a matter of taking anything away from them, but of preventing future investors from coming in and using up the water at a rate which will leave them in a short time stranded on arid farms.

Western Waters

The waters of the Plains are limited in quantity. Their best possible use offers no easy solution to the problems of the farmer of the Plains. Yet good use of these scattered waters can aid in correcting the harm caused by the irregularity of the Plains' rainfall. And it is the very lack of water in the Plains that makes it of such importance that this water be wisely and sparingly used.

To carry this philosophy a step further: The highest benefit will be obtained from the available western waters only by the careful integration of them into a planned agricultural economy. If waters are available, in an area that is essentially range land, those waters should be integrated into a range economy. That is, the waters should first be applied to the production of those crops that will best dovetail into range practices—feed crops. For while one irrigator can quite possibly irrigate crops that do not fit into the surrounding dryland economy, a large number of them cannot establish a stable econ-

omy on such a basis. In the long run, the area does not realize the full benefit from the available waters that it would realize if the waters were utilized in a planned regional economy.

Although the Hereford and similar areas can establish a large potato growing enterprise, how long they can maintain it over a long period of time is a question. Such an enterprise is not compatible with the economy of the western arid portion of the High Plains. There is, for one thing, the question of markets. Up until this year the potato acreage has been absorbed by local markets. With the continued advance, local growers undoubtedly will have to compete sooner or later with the national potato market. Nor will the Hereford growers have anything else to fall back on if their potato crop or the potato market fails. Furthermore, because the Hereford and Plainview areas are comparatively new, the various insects and diseases that usually infest old established potato growing areas have not yet made their appearance. In the course of time, however, their presence can be expected to cause considerable labor and expense.

What You Can Do

The problem has perhaps been most clearly stated by the Texas Planning Board:

> Certain specific areas in which the ground water supply is already over-taxed are in urgent need of some means to protect this supply from further withdrawals. Other sections are making greater withdrawals on their ground-water supply each year, which will eventually exceed the rate of ground-water flow. These sections will need to protect against lowering water tables, which is the inevitable consequence of over-development.

If you are farming in such a section as these described, or are in any way investing in such farming, you do not have to wait passively for a solution. If you are interested in what is going to happen to your water, there are several things you can do about it.

In the first place, you can inform yourself thoroughly on the situation as regards your section. Look around your area and see whether there is a danger of excessive demands being made on the ground-water supply. You do not necessarily have to be a hydraulic engineer to determine this. If you are living in an area that has never been blessed by any too much water, but within which during the past few years a lot of ground water has suddenly been recovered for irrigation purposes, it might be well for you to consider that fact in the light of such brief information as is given here. Or if there is talk of starting such an enterprise, you might well consider how you would fit into it. At the very least it would be prudent to get some advice from a technician as to how long the ground water in your area is likely to be available at any given rate of recovery. You could

very easily find yourself in a situation where you are now making a living raising feed crops for stock, where for a few years you would make more money raising, say, potatoes, and where afterwards you would have no water either for the potatoes or the feed crops.

Control Through Law

The possibility of control, and of what form it should take, has been briefly mentioned. The New Mexico law provides that anyone in that State who wants water for industrial or irrigation purposes must apply to the State engineer. Publication of your application has to be made, and, if there are objectors, an open hearing is held in the courthouse of the county in which the proposed well is to be located. If it appears at the hearing that there are no unappropriated waters in the designated source, or that the proposed appropriation would impair existing water rights from that source, the application is denied. The law does not extend to existing water rights, however.

Such a law for Texas or any other State is not necessarily recommended here. The situation may be far different in your State, and require a different form of control. In Texas, for instance, the diversity of the agriculture and the climate is such that it is possible no general law can be fairly made. But in that case it would still be possible to pass an enabling act of some sort which would allow farmers in a given area to put that area under control. In many cases, you may find that you already have the power to do this through some law or ordinance.

County Committees

It is possible that your county or State land-use planning committee would be useful here. In Deaf Smith County, Tex., for instance—which includes the Hereford area—the county committee is already actively engaged in investigating the ground-water problem in connection with potato production. The committee in your county could quite possibly inform itself on the county's situation in regard to the ground-water supply, and then act for the common good.

But whether it is done through the county committee or otherwise, if the ground water in your area is rapidly diminishing, you are going to face a serious problem some day. And it is the people of your county themselves who can best decide—once they have the information—what should be done to meet it. There is not enough water in the Plains to allow a drop of it to be wasted.

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